

Notice of Allowability

Application No.

10/006,900

Examiner

Jordan Hamann

Applicant(s)

NEE, DIDIER JOHANNES R. VAN

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to Amendment filed on 12/27/2005.
2. ☒ The allowed claim(s) is/are 1-4 & 6-10 (now renumbered as 1-9).
3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☐ All b) ☐ Some* c) ☐ None of the:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____ *Chau T. Nguyen*

CHAU NGUYEN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600

EXAMINER'S AMENDMENT

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Kevin Mason on 3 April 2006.

The application has been amended as follows:

Claims 11 and 12 have been cancelled.

On pages 3 to 4 of the specification, replace the last and first paragraphs with:

To this end a communication system of the kind described in the above paragraph is according to the invention characterized in that the training means are capable of generating a training code with at least nearly ideal cyclic auto-correlation properties such that its cyclic auto-correlation function is at least nearly zero for all cyclic shifts, in that the transmission means are capable of concurrently sending said training code in a mutually shifted manner and in that the reception means are capable of performing a cyclic auto-correlation with respect to a received training signal. Because of the cyclic auto-correlation properties of the training code applied in accordance with the invention it is achieved that the auto-correlation performed on the received training signal leaves no or hardly no by-products. Instead, with ideal auto-correlation properties, the output of the auto-correlation operation at the reception side will be either $n \cdot h_i$ or zero, where h_i is one of the constants to be estimated and n is a known

normalization factor. In fact the auto-correlation properties need not be absolutely ideal but may deviate to a small extent from the ideal situation, leaving sufficient certainty to derive the required constants. Because the transmitters send the training code concurrently in time, the invention, in theory, requires only one training symbol's duration to recover all constants h_i .

The auto-correlation operation requires that the training code be multiplied by all itself and by all its cyclic shifts to render the above product. This may be effected by sending not only the training code but also its cyclic shifts to the reception means and multiplying these codes with the training code generated by the reception means. In a preferred embodiment, however, the communication system according to the invention is characterized in that the reception means are capable of generating the cyclic shifts of a received training code and to correlate these with said training code. In this case, only the training code has to be sent and this code as well as all cyclic shifts are generated at the reception side. It not only limits this embodiment transmission time and hence training time, it also avoids any distortion or other noise of the correlation products.

On page 5 replace the second paragraph with:

In yet another specific embodiment, the communication system according to the invention is characterized in that the training code y is derived from a maximal length sequence x with an uneven length L , having an auto-correlation of -1 for all cyclic shifts, such that at least approximately $y = x + j/\omega L$. A maximal length sequence has an auto-correlation of -1 for all cyclic shifts. A sequence of this kind with an uneven length can

be modified into the above code y, which is suitable for use in the communication system according to the invention.

On page 5 replace the last paragraph with:

In a further preferred embodiment, the communication system according to the invention is characterized in that the training means comprise a pre-correction filter for processing the training code. A pre-correction filter as used in this embodiment is not absolutely necessary, but without it the reception means generally will have to perform a correction. The additional complexity and possible signal noise may be saved by pre-correcting the training signals before they are sent.

On page 7 in the Brief Description of the Drawings replace:

The invention will be described in further detail below along the lines of a specific example and with reference to the accompanying drawings. In the drawings:

Figure 2 is the in phase part of the correlation output of a receiver upon reception of a training signal within the system of Figure 1 for two transmit antennas;

On page 15 replace the last paragraph with:

Although the invention has been described in further detail with reference to merely a number of embodiments, it will be appreciated that the invention is by no means limited to the examples given. On the contrary a skilled person will be able to arrive at numerous different embodiments and variation without departing from the scope and spirit of the present invention. As such he may avail himself of other codes with ideal or nearly ideal cyclic auto-correlation properties to be used as training codes. Besides the aforementioned Frank and Zadoff-Chu sequences, for instance maximum

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length sequences, having an auto-correlation of -1 for all cyclic shifts, may be used as a basis of such an alternative code.

REASONS FOR ALLOWANCE

Claims 1-4 & 6-10 are allowed.

The following is an examiner's statement of reasons for allowance: The prior art fails to teach or make obvious a transmission means concurrently sending a training code with nearly ideal cyclic auto-correlation properties in a mutually shifted manner and a receiving means capable of performing a cyclic auto-correlation with respect to a received training signal as recited in claim 1.

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Mueller (US 5,450,456) teaches measuring frequency deviation between a transmitter and receiver using finite sequences whose cyclic autocorrelation for mutually shifted sequences is zero.

Moreland (US 5,790,598) teaches a block decision feedback equalizer using a Frank code as a training sequence.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jordan Hamann whose telephone number is (571) 272-

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8564. The examiner can normally be reached on Monday-Thursday 8:30-5:30 and alternate Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chau Nguyen can be reached on (571) 272-3126. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

JJH